[Claims]

1. A coin delivery unit comprising: a conveyor belt adapted to be rotated in a coin conveying direction; and a separating roller disposed over the conveyor belt through a coin passage gap for passage of one coin at a time and adapted to be rotated in such a manner that the peripheral surface thereof opposed to the conveyor belt moves in a direction opposite to the coin conveying direction of the conveyor belt, coins stacked on the conveyor belt being conveyed while being separated one by one, the coin delivery unit further comprising a belt guide member, the belt guide member including: a gap forming portion of a convex shape disposed on an inner periphery side of the conveyor belt and formed along the coin conveying direction at a position opposed to the separating roller through the coin passage gap; and belt relief portions formed on both sides of the gap forming portion and able to form a gap larger than the coin passage gap.

2. A coin delivery unit according to claim 1, wherein the conveyor belt is divided in two in its transverse direction and the gap forming portion of the belt guide member is positioned between the divided belts.

[Detailed Description of the Invention]

[0001]

[Technical Field of the Invention]

The present invention relates to a coin delivery unit to be used, for example, in an automatic change delivery system which is suitable for use in a connected state to POS terminal or ECR.

[0002]

[Prior Art]

In a conventional automatic change delivery system, coins which are in a mixed state of various types of coins are introduced at a time from an inlet, then are checked whether each of them is a specie or not, thereafter are sorted coin by coin and are stored in a coin receptacle portion, then specified type and number of coins are delivered.

[0003]

Fig. 5 is a plan view showing an example of a conventional automatic change delivery system 100, which system 100 will now be described along the flow of coins. First, coins are introduced at a time from a coin inlet 101 formed on the right lower side of Fig. 5 and are conveyed by an inlet belt 102. The coins are then delivered one by one by an inlet roller 103 and a conveyed in a row. The coins thus conveyed in a row are delivered from the inlet belt 102 to a conveyor belt 104 and are checked for outside

diameter by an outside diameter checker 105 while being conveyed by the conveyor belt 104. As a result, if a coin being conveyed is not a specie or if a coin receptacle portion to be described later is full loaded, the coin is rejected by a reject overflow portion 106. The coin thus rejected by the reject overflow portion 106 is received into a reject overflow coin receptacle portion 107 provided under the reject overflow portion 106.

[0004]

A coin which has passed the reject overflow portion 106 is delivered to a conveyor belt 108 and further, in the course of being delivered to a succeeding conveyor belt 109, the advancing direction of the coin is changed at a right angle by a direction changer 110. Thus, coins are conveyed in a predetermined direction by a coin conveying section 111 which is composed of the inlet belt 102, inlet roller 103 and conveyor belts 104, 108, 109. The coin whose advancing direction has been changed is then guided to a coin sorting section 113, the coin sorting section 113 having sorting holes 112 coin type by coin type which holes become larger in width dimension successively along the conveyor belt 109. The sorting holes 112 are of sizes corresponding respectively to the diameters of 1-, 5-, 10-, 50-, 100- and 500-yen coins and six such sorting holes are

provided. Consequently, coins drop successively from the sorting holes 112 formed coin type by coin type.

[0005]

At positions where the coins drop from the sorting holes 112 there are provided coin receptacle portions 115 which are partitioned by partition plates 114. Conveyor belts 116 for delivery and conveyance of coins are disposed rotatably at bottoms of the coin receptacle portions 115 respectively coin type by coin type, whereby the coins received in the coin receptacle portion 115 are conveyed toward outlets. However, the coins dropped into the coin receptacle portions 115 from the sorting holes 112 are conveyed in a stacked state near the respective dropped positions and therefore it is necessary that the stacked coins be separated one by one and conveyed. To this end, when the conveyor belts 116 are driven, the coins stored in the coin receptacle portions 115 are conveyed through a separating roller 117 in the course of conveyance thereof.

[0006]

The coins separated one by one by the separating roller 117 continue to be conveyed by the conveyor belts 116 and reach a coin stand-by portion 121 which causes a predetermined number of coins to be arranged in a row and stand by constantly coin type by coin type. The coin

stand-by portion 121 causes a predetermined number of coins to stop and stand by temporarily and the operation thereof is controlled so as to deliver a required number of coins in accordance with a command provided from POS terminal or ECR. That is, the coins received in the coin receptacle portions 115 are delivered to predetermined coin delivery positions by means of coin delivery portions 122 which include the conveyor belts 116 respectively as main components. The coins thus delivered to the coin delivery positions are gathered together to a coin delivery port 123 having an upper opening. The casher can grasp the coins which have been delivered together to the coin delivery port 123 and then deliver them as change to the customer. [0007]

The separating and conveying operation by the separating roller 117 for the coins stacked on the conveyor belts 116 will now be described with reference to Fig. 6 which is a schematic side view and Fig. 7 which is a schematic plan view. On the inner periphery side of the conveyor belts 116 there are disposed a pair of driving roller 118 and driven roller 119 and a flat belt guide plate 120 for receiving the lower surface on the inner periphery side of the belts flatwise, which components are disposed in an upwardly inclined state as a whole. The

conveyor belts 116 and the separating roller 117 are disposed through a coin passage gap G which permits only one coin C to pass therethrough. Further, the conveyor belts 116 and the separating roller 117 are constructed so as to be rotated in the same direction. That is, both are rotated by the same drive source (motor) so that the conveyor belts 116 rotate in the coin conveying direction, while the peripheral surface of the separating roller 117 opposed to the conveyor belts move in the opposite direction.

[0008]

Consequently, in the event a certain coin included in the stacked coins C should be pinched between a conveyor belt 116 and the separating roller 117, the coin is pushed back to the upstream side in the coin conveying direction with a frictional force induced between the coin and the separating roller 117. Therefore, another coin which underlies that coin undergoes the conveying force in the coin conveying direction of the conveying belt 116 and passes through the coin passage gap G formed between the conveying belt and the separating roller 117. In this way coins are delivered successively one by one.

[0009]

[Problem to be Solved by the Invention]

However, since the coins C on the conveyor belts 116 are stacked in an irregular state on the conveyor belts 116, there sometimes is a case where they cannot be separated in a regular manner, depending on a stacked state of coins C in the coin separating portion. For example, as shown in Fig. 6, when there is a coin C3 which is superimposed on coins C1 and C2 and which is trying to get in between the separating roller 117 and the associated conveying belt 116 in a forwardly inclined state, since there are the coins C1 and C2 upstream of the coin C3, the coin C1 cannot be moved back by the returning force resulting from rotation of the separating roller 117 and it is impossible to cancel the superimposed state of the coins C3, C1 and C2, thus contributing to one cause of coin jam. Particularly, in such a state as shown in Fig. 6, the conveying force of the conveyor belt 116 for the coins C1 and C2 lying on the upstream side exhibits a wedging action against the forwardly inclined coin C3 and a force F acting in a direction of pressure-contact with the belt is exerted on a front end of the coin C3, so that the force acting in the delivery direction for the coin C3 increases and it becomes more and more difficult for the separating roller 117 to push back the coin C3. As a result, a large load is imposed on the drive system for the separating roller 117.

[0010]

Accordingly, it is an object of the present invention to provide a coin delivery unit which can cancel a superimposed state of coins positively with use of a returning force of a separating roller, permitting the coins to be separated and conveyed stably one by one, even when a coin which is in a superimposed state with other coins gets in between a conveyor belt and the separating roller.

[0011]

[Means for Solving the Problem]

According to the invention defined in claim 1 there is provided a coin delivery unit comprising a conveyor belt adapted to be rotated in a coin conveying direction and a separating roller disposed over the conveyor belt through a coin passage gap for passage of one coin at a time and adapted to be rotated in such a manner that the peripheral surface thereof opposed to the conveyor belt moves in a direction opposite to the coin conveying direction of the conveyor belt, coins stacked on the conveyor belt being conveyed while being separated one by one, characterized by further comprising a belt guide member, the belt guide member comprising a gap forming portion of a convex shape and belt relief portions formed on both sides of the gap

forming portion and able to form a gap larger than the coin passage gap, the gap forming portion being disposed on an inner periphery side of the conveyor belt and formed along the coin conveying direction at a position opposed to the separating roller through the coin passage gap.

[0012]

According to this construction, when coins stacked on the conveyor belt get in between the conveyor belt and the separating roller in a mutually superimposed state of the coins, even if there occurs a force acting in a direction of pressure-contact with the belt, the force acting in the coin delivery direction does not increase because the belt is deformed in the relief direction in accordance with the belt relief portions to form a gap larger than the coin passage gap. At this time, the coin passage gap between the conveyor belt and the separating roller is maintained by the convex-shaped gap forming portion disposed along the coin conveying direction, so that not only there is no fear of passage of two or more coins at a time, but also the area of contact of a coin being returned by the separating roller with the conveyor belt decreases to about the width of gap forming portion and so does the force acting in the coin delivery direction. Under such a condition, the superimposed state of coins can be cancelled by the

returning force of the separating roller, thereby permitting the coins to be separated and conveyed one by one positively.

[0013]

According to the invention defined in claim 2, the conveyor belt in the coin delivery unit of claim 1 is divided in two in its transverse direction and the gap forming portion of the belt guide member is positioned between the divided belts. With this construction, the divided belts can be easily deformed in the relief direction in the belt relief portions; besides, since the gap forming portion not having a conveying force forms the coin passage gap directly, the area of contact of the coin being returned by the separating roller with the conveyor belts (divided belts) decreases and so does the force acting in the coin delivery direction, thus permitting the coin to be returned more easily by the separating roller.

[0014]

[Mode for Carrying Out the Invention]

A first embodiment of the present invention will now be described with reference to Figs. 1 to 3. Fig. 1 is a schematic side view of a coin delivery unit, Fig. 2 is a schematic plan view thereof, and Fig. 3 is a schematic perspective view showing mainly a conveyor belt, etc. The

coin delivery unit of this embodiment is also applied to the coin separating and conveying portion between each coin receptacle portion 115 and coin stand-by portion 121 in such an automatic change delivery system 100 as shown in Fig. 5. As to the entire construction thereof, the automatic change delivery system 100 is utilized.

[0015]

First, the coin delivery unit of this embodiment comprises as basic components a conveyor belt 1 and a separating roller 2 which are disposed between each coin receptacle portion 115 and coin stand-by portion 121. The conveyor belt 1 is made up of belts 1a and 1b divided in two in its transverse direction. On the inner periphery side of the conveyor belt 1 are disposed not only a pair of driving roller 3 and driven roller 4 but also a flat belt guide plate (belt guide member) 5 for basically receiving the inner periphery-side lower surface of the belt. These components are disposed so as to be upwardly inclined toward the coin stand-by portion 121 as a whole. The conveyor belt 1 and the separating roller 2 are disposed through a coin passage gap G which permits only one coin C to pass therethrough at a time. Further, the conveyor belt 1 and the separating roller 2 are constructed so as to be rotated in the same direction. That is, the conveyor belt

1 and the separating roller 2 are rotated by the same drive source (motor) in such a manner that the conveyor belt 1 rotates in the coin conveying direction and the peripheral surface of the separating roller opposed thereto moves in the opposite direction.

[0016]

In the belt guide plate 5 used in this embodiment, as shown in Fig. 3, a convex-shaped gap forming portion 5a for forming a predetermined coin passage gap G is formed along the coin conveying direction at a position opposed to the separating roller 2. The gap forming portion 5a is positioned between the divided belts 1a and 1b and is exposed to the exterior to form the coin passage gap G directly between it and the separating roller 2. The gap forming portion 5a is positioned within the coin passing width. The belt guide plate 5 is formed with flat portions 5b and 5c for receiving the inner periphery surfaces of the divided belts 1a and 1b respectively on both right and left sides of the gap forming portion 5a. In the flat portions 5b and 5c, downwardly depressed belt relief portions 5d and 5e are formed near the position opposed to the separating roller 2.

[0017]

In such a construction, in the event a certain coin

included in stacked coins C on the conveyor belt 1 should be pinched between the conveyor belt 1 and the separating roller 2, the coin is pushed back to the upstream side in the coin conveying direction with a frictional force created between it and the separating roller 2. Consequently, another coin which underlies that coin undergoes coin conveying force of the conveying belt 1 acting in the coin conveying direction and passes through the coin passage gap G formed between the conveyor belt 1 and the separating roller 2. In this way coins are delivered successively one by one.

[0018]

Since the coins C on the conveyor belt 1 are stacked in an irregular stage, they present various superimposed states in the separating portion, but generally the coins are conveyed while being mutually superimposed transversely in a zigzag fashion on the conveyor belt 1. For example, it is here assumed that a coin C3 tends to get in between the separating roller 2 and the conveyor belt 1 in a somewhat forwardly inclined attitude while being superimposed on coins C1 and C2. In this case, the other coins C1 and C2 lie upstream of the coin C3 and the conveying force of the conveyor belt 1 for the coins C1 and C2 exhibits a wedging action against the forwardly

inclined coin C3, so that a force acting in a direction of pressure-contact with the belt is exerted on a front end of the coin C3. In this portion, however, the belt relief portion 5d is formed in the belt guide plate 5 in the case of the illustrated example, so that the portion of the divided belt 1a which has undergone the force acting in the direction of pressure contact with the belt by the front end of the coin C3, the coin C3 now being in a lowered state to the left front side, is deformed toward the belt relief portion 5. Thus, the force acting in the coin C3 delivery direction does not increase. At this time, at least one side near the center of the coin C3 is conveyed while being supported over the gap forming portion 5a and is prevented from sinking. Thus, the divided belt 1a is not deformed more than necessary to such an extent as permits the passage of coin C3. Under the same condition, even when the coin C3 is conveyed mainly on the divided belt 1b side, the divided belt 1a is deformed to the belt relief portion 5e side and the force acting in the delivery direction on the coin C3 does not increase. Particularly, in this embodiment, since the conveyor belt 1 is divided into divided belts 1a and 1b, the divided belts are easy to be deformed in the relief direction in the relief portions 1a and 1b. In such a condition, the coin C3 can be

returned positively with the returning force of the separating roller 2 and the overlapped state of coins can be cancelled. For example, after return and separation of the coin C3, the coin C1 can be conveyed to the downstream side. At this time, the coin passage gap G between the conveyor belt 1 and the separating roller 2 is maintained by the convex-shaped gap forming portion 5a formed along the coin conveying direction and a part of the coin C1 is sure to pass over the gap forming portion 5a, so that there is no fear of two or more coins passing at a time through the belt relief portion 5d or 5e. As a result, a heavy load is not imposed on the drive system for the separating roller 2.

[0019]

According to this embodiment, moreover, since the gap forming portion 5a not having a coin conveying force is positioned between the divided belts 1a and 1b, even if the coin C3 to be returned by the separating roller 2 is conveyed over the central portion (the gap forming portion 5a) and there occurs such a condition as shown in Fig. 1, the force acting in the coin delivery direction decreases because the gap forming portion 5a itself with which the front end of the coin C3 is in contact does not have a coin conveying force. Under this condition, the overlapped

state of coins can be cancelled by the returning force of the separating roller 2.

[0020]

A second embodiment of the present invention will be described with reference to Fig. 4. The same portions as in the first embodiment are identified by the same reference numerals, and explanations thereof will be omitted. Fig. 4 is a schematic perspective view mainly showing the conveyor belt, etc. The conveyor belt 1 used in this second embodiment is a single belt. As to a belt guide plate 6, a gap forming portion 6a for defining the coin passage gap G between the conveyor belt 1 and the separating roller 2 is formed level with a flat portion 6b, and near the portion opposed to the separating roller 2 there are formed belt relief portions 6c and 6d which are downwardly depressed on both sides of the gap forming portion 6a.

[0021]

Also by this second embodiment there are obtained the same effects as in the first embodiment. Particularly, in comparison with the prior art, the desired object can be achieved by only replacing the belt guide plate 120 with the belt guide plate 6.

[0022]

Although in the above embodiments the belt relief portions 5d, 5e, 6c and 6e are formed by recesses, they may be formed by notches for example.

[0023]

[Effect of the Invention]

Since the coin delivery unit defined in claim 1 comprises a belt guide member, the belt guide member comprising a gap forming portion of a convex shape and belt relief portions formed on both sides of the gap forming portion and able to form a gap larger than the coin passage gap, the gap forming portion being disposed on an inner periphery side of the conveyor belt and formed along the coin conveying direction at a position opposed to the separating roller through the coin passage gap, even if a coin which is in a superimposed state on other coins gets in between the conveyor belt and the separating roller, the superimposed state of coins is cancelled positively with the returning force of the separating roller and coins can be separated one by one and conveyed stably.

[0024]

Particularly, according to the invention defined in claim 2, a divided belt can be easily deformed in a relief direction in a belt relief portion and the gap forming portion not having a conveying force forms the coin passage

gap, so that the force acting in the coin delivery direction on a coin which is to be returned by the separating roller can be decreased and hence the coin can be made easier to return by the separating roller.

[Brief Description of the Drawings]

Fig. 1 is a schematic side view showing a first embodiment of the present invention;

Fig. 2 is a schematic plan view thereof;

Fig. 3 is a schematic perspective view thereof;

Fig. 4 is a schematic perspective view showing a second embodiment of the present invention;

Fig. 5 is a plan view of a conventional automatic change delivery system;

Fig. 6 is a schematic side view showing a coin delivery unit portion thereof; and

Fig. 7 is a schematic plan view thereof.

[Explanation of Reference Numerals]

1 conveyor belt

1a, 1b divided belts

2 separating roller

5 belt guide member

5a gap forming portion

5d, 5e belt relief portions

6 belt guide member

6a gap forming portion

6c, 6d belt relief portions